

Amendments to the Claims

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device, wherein the vibratory device is positioned within a non expanded portion of the expandable tubular member; and
an actuator device coupled to the expansion device for displacing the expansion device relative to the expandable tubular member.
2. (Original) The apparatus of claim 1, wherein the expansion device comprises: a tapered expansion cone.
3. (Original) The apparatus of claim 2, wherein the expansion device further comprises:
a locking device coupled to the actuator for fixing the position of the expandable tubular member relative to the actuator during the axial displacement of the expansion cone relative to the expandable tubular member.
4. (Original) The apparatus of claim 1, wherein the expansion device comprises:
a rotary expansion device.
- 5-15. Cancelled.

16. (Original) The apparatus of claim 1, wherein the vibratory device comprises:
a fluid powered vibratory device.
17. (Original) The apparatus of claim 1, wherein the vibratory energy comprises:
vibratory energy in one or more planes.
18. (Original) The apparatus of claim 17, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
19. (Original) The apparatus of claim 18, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
20. (Original) The apparatus of claim 17, wherein the vibratory energy comprises:
vibratory energy in a plurality of planes.
21. (Original) The apparatus of claim 20, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
22. (Original) The apparatus of claim 21, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
23. (Original) The apparatus of claim 1, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
24. (Original) The apparatus of claim 23, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
25. (Original) The apparatus of claim 1, wherein the magnitude of the vibratory energy is
constant.

26. (Original) The apparatus of claim 1, wherein the magnitude of the vibratory energy is constant.
27. (Original) The apparatus of claim 1, wherein the plane of the vibratory energy is variable.
28. (Original) The apparatus of claim 1, wherein the plane of the vibratory energy is constant.
29. (Previously Presented) The apparatus of claim 1, wherein the expandable tubular member comprises a wellbore casing.
30. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a pipeline.
31. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a structural support.
32. (Currently Amended) The apparatus of claim 1, further comprising:
a second vibratory device coupled to the expansion device for generating[[on]] vibratory energy to impart rotation to the expansion device.
33. (Original) The apparatus of claim 1, wherein the vibratory device is adapted to impact the expandable tubular member.
34. (Original) The apparatus of claim 1, wherein the vibratory device is adapted to impact the expansion device.
35. (Original) The apparatus of claim 1, wherein the expansion device comprises one or more external arcuate spherical surfaces.

36. (Original) The apparatus of claim 1, wherein the expansion device comprises one or more external arcuate elliptical surfaces.

37. (Original) The apparatus of claim 1, wherein the expansion device comprises one or more external arcuate hyperbolic surfaces.

38. (Original) The apparatus of claim 1, wherein the expansion device comprises one or more external arcuate surfaces that are faceted.

39-42. Cancelled.

43. (Original) The apparatus of claim 1, wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies; and wherein the vibratory energy comprises vibratory energy in a plurality of planes.

44. (Original) The apparatus of claim 1, wherein the vibratory energy has a center frequency of about 40 Hz.

45. Cancelled.

46. (Original) The apparatus of claim 1, wherein the vibratory energy comprises vibratory energy in a plurality of planes; wherein one of the planes is radial; and wherein another one of the planes is longitudinal.

47. (Original) The apparatus of claim 1, wherein the vibratory device coupled to the expansion device generates vibratory energy to agitate the expandable tubular member and the expansion device.

48. (Currently Amended) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device;
injecting vibratory energy into at least one of the expandable tubular member and the expansion device, wherein the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member; and
displacing the expansion device relative to the expandable tubular member during the radial expansion and plastic deformation of the tubular member using an actuator coupled to the expansion device.

49. (Original) The method of claim 48, further comprising:
fixing the position of the expandable tubular member relative to the expansion device during the axial displacement of the expansion device relative to the expandable tubular member.
50. (Original) The method of claim 48, further comprising:
rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.
- 51-61. Cancelled.
62. (Original) The method of claim 48, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises: injecting fluidic materials into the expandable tubular member.
63. (Original) The method of claim 48, wherein the vibratory energy comprises: vibratory energy in one or more planes.
64. (Original) The method of claim 63, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.

65. (Original) The method of claim 64, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
66. (Original) The method of claim 63, wherein the vibratory energy comprises: vibratory
energy in a plurality of planes.
67. (Original) The method of claim 66, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
68. (Original) The method of claim 67, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
69. (Original) The method of claim 48, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
70. (Original) The method of claim 69, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
71. (Original) The method of claim 48, wherein the magnitude of the vibratory energy is
variable.
72. (Original) The method of claim 48, wherein the magnitude of the vibratory energy is
constant.
73. (Original) The method of claim 48, wherein the plane of the vibratory energy is variable.
74. (Original) The method of claim 48, wherein the plane of the vibratory energy is constant.
75. (Previously Presented) The method of claim 48, wherein the expandable tubular member
comprises a wellbore casing.

76. (Original) The method of claim 48, wherein the expandable tubular member comprises a pipeline.

77. (Original) The method of claim 48, wherein the expandable tubular member comprises a structural support.

78. (Original) The method of claim 48, further comprising: injecting vibratory energy into the expandable tubular member and the expansion device.

79. (Original) The method of claim 48, further comprising:
injecting vibratory energy into the expansion device to impart rotation to the expansion device.

80. (Original) The method of claim 48, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:
impacting the expandable tubular member.

81. (Original) The method of claim 48, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:
impacting the expansion device.

82. (Original) The method of claim 48, further comprising:
inserting the expansion device and the expandable tubular member into a preexisting structure; and
injecting vibratory energy into at least one of the expandable tubular member and the expansion device during the insertion.

83. (Original) The method of claim 48, further comprising:
removing the expansion device and the expandable tubular member from a preexisting

structure; and
injecting vibratory energy into at least one of the expandable tubular member and the
expansion device during the removal.

84. (Original) The method of claim 48, wherein the expansion device comprises one or more external arcuate spherical surfaces.

85. (Original) The method of claim 48, wherein the expansion device comprises one or more external arcuate elliptical surfaces.

86. (Original) The method of claim 48, wherein the expansion device comprises one or more external arcuate hyperbolic surfaces.

87. (Original) The method of claim 48, wherein the expansion device comprises one or more external arcuate surfaces that are faceted.

88. (Currently Amended) The method of claim 48, further comprising:
radially expanding and plastically deforming the expandable tubular member by rotating
[[an]]the expansion device within the expandable tubular member.

89. Cancelled.

90. Cancelled.

91. (Original) The method of claim 48, further comprising:
injecting vibratory energy into at least one of the expandable tubular member and the
expansion device from a plurality of discrete spaced apart locations.

92. (Original) The method of claim 48, wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies; and wherein the

vibratory energy comprises vibratory energy in a plurality of planes.

93. (Original) The method of claim 48, wherein the vibratory energy has a center frequency of about 40 Hz.
94. Cancelled.
95. (Original) The method of claim 48, further comprising:
increasing the plasticity and formability of the expandable tubular before the radial expansion and plastic deformation of the expandable tubular member.
96. (Original) The method of claim 48, further comprising:
increasing the plasticity and formability of the expandable tubular during the radial expansion and plastic deformation of the expandable tubular member.
97. (Original) The method of claim 48, further comprising:
injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and
during the radial expansion and plastic deformation of the expandable tubular member:
a) incrementing at least one of the plane, center frequency, and amplitude for the injected vibratory energy;
b) monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
c) repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.
98. (Original) The method of claim 48, further comprising:
injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial

plane, has an initial center frequency, and has an initial amplitude; and during the radial expansion and plastic deformation of the expandable tubular member:

- a) incrementing two or more of the plane, center frequency, and amplitude for the injected vibratory energy;
- b) monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
- c) repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

99. Cancelled.

100. (Original) The method of claim 48, wherein the vibratory energy comprises vibratory energy in a plurality of planes; and wherein the vibratory energy comprises vibratory energy having a frequency distribution having one or more center frequencies.

101. Cancelled.

102. Cancelled.

103. (Original) The method of claim 48, wherein the vibratory energy comprises vibratory energy in a plurality of planes; wherein one of the planes is radial; and wherein another one of the planes is longitudinal.

104. (Currently Amended) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

- means for radially expanding and plastically deforming the expandable tubular member using an expansion device;
- means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device, wherein the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member; and

actuator means for displacing the expansion device relative to the expandable tubular member during the radial expansion and plastic deformation of the expandable tubular member.

105. (Original) The system of claim 104, further comprising:
means for fixing the position of the expandable tubular member relative to the means for displacing the expansion device during the axial displacement of the expansion device relative to the expandable tubular member.
106. (Original) The system of claim 104, further comprising:
means for rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.
- 107-117. Cancelled.
118. (Original) The system of claim 104, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises:
injecting fluidic materials into the expandable tubular member.
119. (Original) The system of claim 104, wherein the vibratory energy comprises:
vibratory energy in one or more planes.
120. (Original) The system of claim 119, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
121. (Original) The system of claim 120, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
122. (Original) The system of claim 119, wherein the vibratory energy comprises:
vibratory energy in a plurality of planes.

123. (Original) The system of claim 122, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
124. (Original) The system of claim 123, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
125. (Original) The system of claim 104, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
126. (Original) The system of claim 125, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
127. (Original) The system of claim 104, wherein the magnitude of the vibratory energy is
variable.
128. (Original) The system of claim 104, wherein the magnitude of the vibratory energy is
constant.
129. (Original) The system of claim 104, wherein the plane of the vibratory energy is variable.
130. (Original) The system of claim 104, wherein the plane of the vibratory energy is constant.
131. (Currently Amended) The system of claim 104, wherein the expandable tubular member
comprises a wellbore casing.
132. (Original) The system of claim 104, wherein the expandable tubular member comprises a
pipeline.
133. (Original) The system of claim 104, wherein the expandable tubular member comprises a

structural support.

134. (Original) The system of claim 104, further comprising:
means for injecting vibratory energy into the expandable tubular member and the
expansion device.
135. (Original) The system of claim 122, wherein one of the planes is longitudinal; and
wherein another one of the planes is radial.
136. (Original) The system of claim 104, further comprising:
means for injecting vibratory energy into the expansion device to impart rotation to the
expansion device.
137. (Original) The system of claim 104, further comprising:
means for reducing the required radial expansion forces during the radial expansion and
plastic deformation of the expandable tubular member.
138. (Original) The system of claim 104, wherein means for injecting vibratory energy into at
least one of the expandable tubular member and the expansion device, comprises:
means for impacting the expandable tubular member.
139. (Original) The system of claim 104, wherein means for injecting vibratory energy into at
least one of the expandable tubular member and the expansion device, comprises:
means for impacting the expansion device.
140. Cancelled.
141. (Original) The system of claim 104, further comprising:
means for injecting vibratory energy into at least one of the expandable tubular member
and the expansion device from a location within the radially expanded and

plastically deformed portion of the expandable tubular member.

142. (Original) The system of claim 104, further comprising:
means for injecting vibratory energy into at least one of the expandable tubular member
and the expansion device from a location within the expansion device.
143. (Original) The system of claim 104, further comprising:
means for increasing the plasticity and formability of the expandable tubular before the
radial expansion and plastic deformation of the expandable tubular member.
144. (Original) The system of claim 104, further comprising:
means for increasing the plasticity and formability of the expandable tubular during the
radial expansion and plastic deformation of the expandable tubular member.
145. (Original) The system of claim 104, further comprising:
means for injecting vibratory energy into one or more of the expansion device and the
expandable tubular member, wherein the injected vibratory energy is provided in
an initial plane, has an initial center frequency, and has an initial amplitude; and
means for during the radial expansion and plastic deformation of the expandable tubular
member:
a) means for incrementing at least one of the plane, center frequency, and
amplitude for the injected vibratory energy;
b) means for monitoring the amount of energy required to continue the radial
expansion and plastic deformation of the expandable tubular member; and
c) means for repeating steps a) and b) until the completion of the radial
expansion and plastic deformation of the expandable tubular member.
146. (Original) The system of claim 104, further comprising:
means for injecting vibratory energy into one or more of the expansion device and the
expandable tubular member, wherein the injected vibratory energy is provided in

an initial plane, has an initial center frequency, and has an initial amplitude; and means for during the radial expansion and plastic deformation of the expandable tubular member:

- a) means for incrementing two or more of the plane, center frequency, and amplitude for the injected vibratory energy;
- b) means for monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
- c) means for repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

147. (Previously Presented) The system of claim 104, wherein means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises: injecting fluidic materials into the expandable tubular member.

148. (Original) The system of claim 104, wherein the vibratory energy comprises vibratory energy in one or more planes; and wherein the vibratory energy comprises vibratory energy having a frequency distribution having one or more center frequencies.

149. (Original) The system of claim 104, wherein the vibratory energy comprises vibratory energy in a plurality of planes; and wherein the vibratory energy comprises vibratory energy having a frequency distribution having one or more center frequencies.

150. Cancelled.

151. Cancelled.

152. (Original) The system of claim 104, wherein the vibratory energy comprises vibratory energy in a plurality of planes; wherein one of the planes is longitudinal; and wherein another one of the planes is radial.